

# Improved Gear Bearings

*... New gear design improves strength and performance while maintaining small size and low cost*



NASA Goddard Space Flight Center (GSFC) offers potential partners a superior evolution of its patented gear bearing technology. The new design incorporates rifle true anti-backlash, improved thrust bearing performance, and phase-tuning techniques for superior low speed reduction. The gear bearing technology combines gear and bearing functions to reduce weight, number of parts, size, and cost, while also increasing capacity and performance.

## Benefits

- **Precise control:** Rifle true anti-backlash produces a planetary transmission with zero backlash, resulting in smoother operation and superior control.
- **Improved thrust bearing:** Helical gear teeth give superior thrust bearing performance.
- **Improved speed reduction:** Through phase tuning, a one-tooth difference between ground and output rings is possible, creating opportunities for significant reduction ratios at both low and high speeds.
- **Less noise and vibration:** More evenly distributed planet loading reduces cyclic loading and rough spots, reducing noise and vibration.
- **Low cost, simple design:** Gear bearings combine gear and bearing functions to reduce materials and cost, while also reducing weight and simplifying the design.
- **Fewer fatigue failures:** Reduced cyclic loading reduces susceptibility to fatigue failures.
- **High strength:** Gear bearings are more structurally rigid and provide higher overall load capacity compared to fixed planetary designs.





## Applications

- **Transportation (including automotive, aircraft, marine, and rail):** Transmissions, electric windows, windshield wipers, steering mechanisms, alternators/generators, engines and propellers, control systems, landing gear, door openers, rudders/steering/leveling controls, winches, rail switching systems
- **Power tools:** Garden equipment, hand tools, lawnmowers, chain saws, log splitters
- **Industrial machinery:** Power presses, lathes and grinders, slitting and rolling equipment, construction equipment, lifting and handling equipment
- **Farm equipment:** Tractors, harvesters, hay rollers
- **Medical equipment:** MRI, CT, PET scanners
- **Toys:** Electric robots, cars, and other motorized toys.

## The Technology

Gear bearings function both as gears and bearings, providing superior speed reduction in a small package. Smoothness and precision control are created through reduced micro chatter and elimination of rotational wobble. The technology provides for tighter mesh, more even gear loading, and reduced friction and wear. NASA's gear bearing technology has been further enhanced with the following:

- To increase thrust bearing point contact loads, helical gear teeth forms (including herringbone) were developed. These provide outstanding thrust bearing performance.
- To provide unprecedented high and low speed reduction, phase tuning was implemented into the design, achieving successful reduction ratios of 325:1. Phase tuning allows differentiation in the number of teeth that must be engaged between input and output rings in a planetary gearset.
- To provide smooth and accurate control, rifle true anti-backlash was incorporated into the gear bearing design to produce a planetary transmission with zero backlash.

Gear bearings are compatible with most gear types, including spur, helical, elliptical, and bevel gears.

## Partnering Opportunities

This technology is part of NASA's Technology Transfer Program, the goal of which is to transfer technologies both into and out of NASA to benefit both the NASA space missions and the American public. NASA invites companies to consider licensing this gear bearing technology for use in mechanical applications.

## For More Information

If you are interested in more information or want to pursue transfer of this technology, please contact:

Office of Technology Transfer  
 NASA Goddard Space Flight Center  
 Greenbelt, MD 20771  
 Phone: 301.286.5810  
 E-mail: XXXXXXXXXXXXX (TBD)

<http://techtransfer.gsfc.nasa.gov/>